

CLAIMS

1. A driving method for an electro-optical device which performs gray-scale display of a plurality of pixels arranged in the form of a matrix, the driving method being characterized in that:

a first period which is part of a single frame is divided into a plurality of sub-fields, and in each sub-field, turning on or off of each pixel is controlled in accordance with a gray-scale level of the pixel; and

in a second period which is the remaining period of the single frame, the pixels are turned on or off in accordance with a threshold voltage of a transmissivity characteristic relative to a voltage applied to electro-optical material used in the electro-optical device.

2. The driving method for an electro-optical device according to Claim 1, the driving method being characterized in that the pixels are only turned on for a period in accordance with the threshold voltage of the transmissivity characteristic within the second period.

3. The driving method for an electro-optical device according to Claim 1, the driving method being characterized in that the second period is dispersed in the period of the single frame.

4. The driving method for an electro-optical device according to Claim 1, the driving method being characterized in that:

the pixels are provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines, and when scanning signals are supplied to the respective scanning lines, the pixels are turned on/off in accordance with voltages applied to the data lines;

in the first period, the scanning signals are sequentially supplied to the respective scanning lines every sub-field, and signals each designating turning on or off of each pixel in accordance with a gray-scale level of the pixel are supplied to the respective data lines which correspond to the respective pixels; and

in the second period, the scanning signals are sequentially supplied to the respective scanning lines, and a signal designating turning on or off of the pixels in accordance with the threshold value of the transmissivity characteristic relative to the voltage applied to the electro-optical material is supplied to the data lines.

5. The driving method for an electro-optical device according to Claim 4, the driving method being characterized in that the second period includes an on period for turning on all the pixels and an off period for turning off all the pixels, and the length of the on period is determined in accordance with the threshold value of the transmissivity characteristic relative to the voltage applied to the electro-optical material.

6. The driving method for an electro-optical device according to

Claim 5, the driving method being characterized in that a temperature is detected, and the length of the on period in the second period is determined in accordance with the detected temperature.

5           7. A driving method for an electro-optical device which performs gray-scale display of a plurality of pixels arranged in the form of a matrix, the driving method being characterized in that:

10           a first period which is part of a single frame is divided into a plurality of sub-fields, and in each sub-field, turning on or off of each pixel is controlled in accordance with a gray-scale level of the pixel; and

15           in a second period which is the remaining period of the single frame, the pixels are turned on in accordance with a threshold voltage of a transmissivity characteristic relative to a voltage applied to electro-optical material used in the electro-optical device.

20           8. The driving method for an electro-optical apparatus according to Claim 1, the driving method being characterized in that the second period is dispersed in the period of the single frame.

          9. The driving method for an electro-optical device according to Claim 1, the driving method being characterized in that:

25           the pixels are provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines, and when scanning signals are supplied to the respective scanning lines, the

09866653-052501

pixels are turned on/off in accordance with voltages applied to the data lines;

in the first period, the scanning signals are sequentially supplied to the respective scanning lines every sub-field, and signals each designating turning on or off of each pixel in accordance with a gray-scale level of the pixel are supplied to the respective data lines which correspond to the respective pixels; and

in the second period, the scanning signals are sequentially supplied to the respective scanning lines, and a signal designating turning on of the pixels for a period in accordance with the threshold value of the transmissivity characteristic relative to the voltage applied to the electro-optical material is supplied to the data lines.

10. The driving method for an electro-optical apparatus according to Claim 9, the driving method being characterized in that a temperature is detected, and the length of the second period is determined in accordance with the detected temperature.

11. The driving method for an electro-optical device according to Claims 7 to 10, the driving method being characterized in that, as far as displaying of the lowest gray-scale level is concerned, the pixels are turned off in the second period.

12. The driving method for an electro-optical device according to Claims 7 to 10, the driving method being characterized in that the

pixels are turned on in the second period regardless of gray-scale data.

13. A driving circuit for an electro-optical device, which drives pixels including pixel electrodes provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines and switching devices for establishing conduction between the data lines and the pixel electrodes when scanning signals are supplied to the scanning lines, the driving circuit characterized by comprising:

a scanning-line driving circuit for sequentially supplying, in a first period forming part of a single frame, the scanning signals to the respective scanning lines every sub-field which is obtained by dividing the first period and for sequentially supplying the scanning signals, which make the switching devices conducting, to the respective scanning lines in a second period of the single frame, excluding the first period; and

a data-line driving circuit for supplying, in the first period, signals each designating turning on or off of each pixel in accordance with a gray-scale level of the respective pixels every sub-field to the data lines which correspond to the pixels in a period for supplying the scanning signals to the scanning lines which correspond to the pixels and for supplying, in the second period, a signal which designates turning on or off of the pixels in accordance with a threshold value of a transmissivity characteristic relative to a voltage applied to electro-optical material used in the electro-optical device to the data lines which correspond to the pixels.

14. The driving circuit for an electro-optical device according to Claim 13, the driving circuit being characterized in that only a signal which designates turning off of the pixels is supplied in the second period.

15. A driving circuit for an electro-optical device, which drives pixels including pixel electrodes provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines and switching devices for establishing conduction between the data lines and the pixel electrodes when scanning signals are supplied to the scanning lines, the driving circuit characterized by comprising:

a scanning-line driving circuit for sequentially supplying, in a first period forming part of a single frame, the scanning signals to the respective scanning lines every sub-field which is obtained by dividing the first period and for sequentially supplying the scanning signals, which make the switching devices conducting, to the respective scanning lines in a second period of the single frame, excluding the first period; and

a data-line driving circuit for supplying, in the first period, signals each designating turning on or off of each pixel in accordance with a gray-scale level of the respective pixels every sub-field to the data lines which correspond to the pixels in a period for supplying the scanning signals to the scanning lines which correspond to the pixels and for supplying, in the second period, a signal which designates

turning on of the pixels in accordance with a threshold value of a transmissivity characteristic relative to a voltage applied to electro-optical material used in the electro-optical device to the data lines which correspond to the pixels.

5

16. An electro-optical device characterized by comprising:

a device substrate comprising pixel electrodes provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines and switching devices, which are provided for the respective pixel electrodes, for controlling conduction between the data lines and the pixel electrodes based on scanning signals supplied through the scanning lines;

an opposing substrate comprising a counter electrode which is opposed to the pixel electrodes;

electro-optical material held between the device substrate and the opposing substrate;

a scanning-line driving circuit for sequentially supplying, in a first period forming part of a single frame, the scanning signals to the respective scanning lines every sub-field which is obtained by dividing the first period and for sequentially supplying the scanning signals, which make the switching devices conducting, to the respective scanning lines in a second period of the single frame, excluding the first period; and

a data-line driving circuit for supplying, in the first period, signals each designating turning on or off of each pixel in accordance

09856853-052501

10

15

20

25

with a gray-scale level of the pixel every sub-field to the data lines which correspond to the pixels in a period for supplying the scanning signals to the scanning lines which correspond to the pixels and for supplying, in the second period, a signal which designates turning on or off of the pixels in accordance with a threshold value of a transmissivity characteristic relative to a voltage applied to the electro-optical material used in the electro-optical device to the data lines which correspond to the pixels.

17. The electro-optical device according to Claim 16, characterized in that only a signal which designates turning on of the pixels is supplied in the second period.

18. An electro-optical device characterized by comprising:  
a device substrate comprising pixel electrodes provided corresponding to respective intersections of a plurality of scanning lines and a plurality of data lines and switching devices, which are provided for the respective pixel electrodes, for controlling conduction between the data lines and the pixel electrodes based on scanning signals supplied through the scanning lines;

an opposing substrate comprising a counter electrode which is opposed to the pixel electrodes;

electro-optical material held between the device substrate and the opposing substrate;

a scanning-line driving circuit for sequentially supplying, in a



first period forming part of a single frame, the scanning signals to the respective scanning lines every sub-field which is obtained by dividing the first period and for sequentially supplying the scanning signals, which make the switching devices conducting, to the respective scanning  
5 lines in a second period of the single frame, excluding the first period; and

0955253-052501  
10 a data-line driving circuit for supplying, in the first period, signals each designating turning on or off of each pixel in accordance with a gray-scale level of the pixel every sub-field to the data lines which correspond to the pixels in a period for supplying the scanning signals to the scanning lines which correspond to the pixels and for supplying, in the second period, a signal which turns on the pixels in accordance with a threshold value of a transmissivity characteristic relative to a voltage applied to the electro-optical material used in  
15 the electro-optical device to the data lines which correspond to the pixels.

19. The electro-optical device according to Claim 16 or 18, characterized in that:

20 a two-level signal is supplied to the counter electrode; and the polarity of each signal which designates turning on or off of the pixel is inverted in accordance with the level of the two-level signal.

25 20. The electro-optical device according to Claim 16 or 18,

a potential of the counter electrode is fixed at a predetermined reference potential; and

21. The electro-optical device according to Claim 20,  
characterized in that:



15           the device substrate is formed of a semiconductor substrate; and  
          the scanning-line driving circuit and the data-line driving circuit  
are formed on the device substrate, and the pixel electrodes are  
reflective.

add  $a'$